Thermo Fisher
S C I E N T I F I C
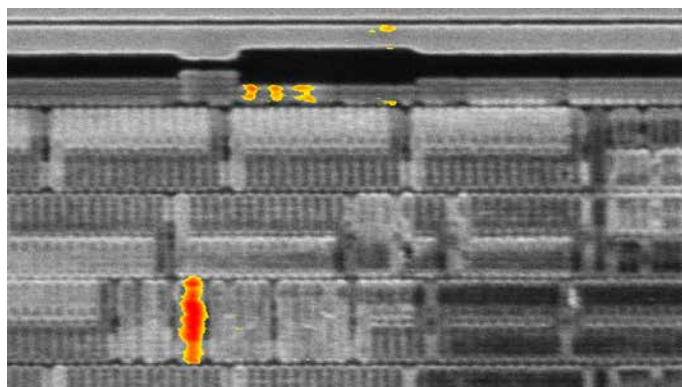
Meridian EX System
E-beam fault localization for advanced logic devices

Designed to meet the needs of logic failure analysis at advanced technology nodes, the Meridian EX System enables front- or backside probing of <5 nm node devices, even when they are accompanied by backside power distribution networks.

The Thermo Scientific™ Meridian EX System offers advanced resolution, non-contact probing capability for the semiconductor failure analysis market. The system is comprised of a top-down scanning electron microscope column that provides the foundation of the system's exceptional high-resolution imaging and probing capability.

The Meridian EX electron beam column is specifically designed to meet the needs of e-beam probing applications. It offers continuous electron beam current operation for probing and imaging as well as a high bandwidth, pulsed electron beam to measure frequency spectra for timing analysis or design debug at Gigahertz frequencies. The column also features an immersion lens, which enables high efficiency secondary electron collection for maximum voltage contrast signal detection.

The system is designed for easy integration into existing failure analysis workflows, with multiple vacuum-compatible feedthroughs to allow customized external test equipment connectivity and electrical stimulation of the device under test. Integration is also assisted by the use of industry standard Meridian (Sierra) operating software.

Key features

Defect localization resolution to meet advanced semiconductor roadmap requirements

Electron beam probing to access defects obscured by backside power distribution networks

Compatibility with Thermo Scientific analytical workflows

Timing analysis and at-speed design debug using high-speed electron beam blanking
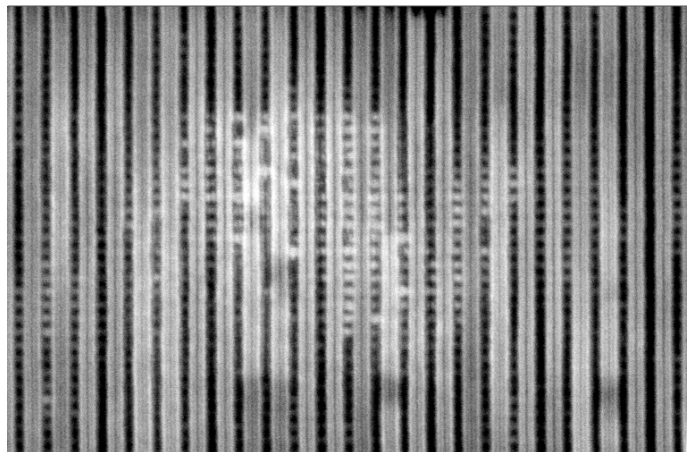
Backside die image of 5 nm device using the Meridian EX System.
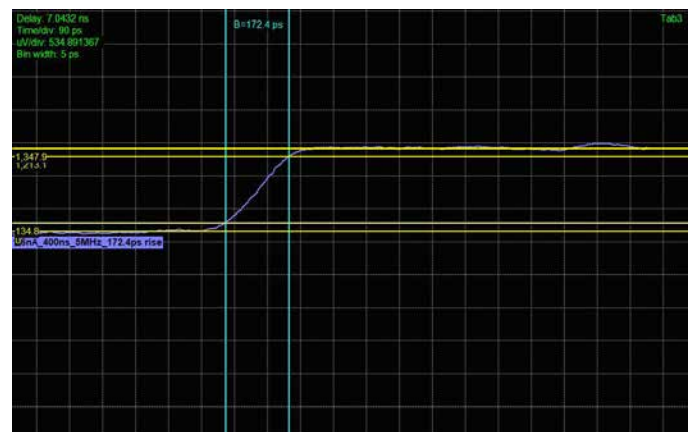
The Meridian EX System validates transistor characteristics with "at-speed" transistor probing.

Meridian EX System-generated frequency map showing transistor operating activity.

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Specifications

Beam current:
- 1 pA – 20 nA

E-beam accelerating voltage:
- 30 KeV – 500 eV in discrete pre-calibrated steps

Electron optics
- Extreme high-resolution field emission Thermo Scientific Elstar™ SEM Column with:
  - Immersion magnetic objective lens
  - High-stability Schottky field emission gun to provide stable high-resolution analytical current
- Integrated fast beam blanker
  - <200 ps waveform rise time
  - Discrete pulse width selections

Detectors
- Elstar Column in-lens SE/BSE detector (TLD-SE, TLD-BSE)
- Elstar Column in-column SE/BSE detector (ICD)
- Everhart-Thornley SE detector (ETD)
- Thermo Scientific Nav-Cam™ Sample Navigation Camera
- Integrated beam current measurement capability

Electron voltage imaging and probing
- Electron voltage imaging and probing (EVx) covers a broad operating range of frequencies to visualize transistor activity
- Integrated digital lock-in amplifier for phase and amplitude analysis
- Bandwidth: <5 MHz (non-pulsed), <2 GHz (pulsed)

Vacuum system:
- Complete oil-free vacuum system
- Chamber vacuum: < 2.6×10–6 mbar (after 24 hours pumping)
- Evacuation time: < 5 minutes
- CryoCleaner cold trap

Plasma cleaner:
- 20 W plasma cleaner

Image processor:
- Dwell time range: 25 ns – 25 ms/pixel
- Up to 6144×4096 pixels
- File type: TIFF (8-, 16-, 24-bit), BMP or JPEG standard
- Single-frame or 4-view image display
- SmartSCAN (256 frame average or integration, line integration and averaging, interlaced scanning)
- DCFI (drift compensated frame integration)

Stage:
- XY travel: +/-77 mm
- Z range: 35 mm
- Load capacity: 1.5 kg
- Load board size: 9x9 inches (actual size may vary depending on mounting scheme and connectors)
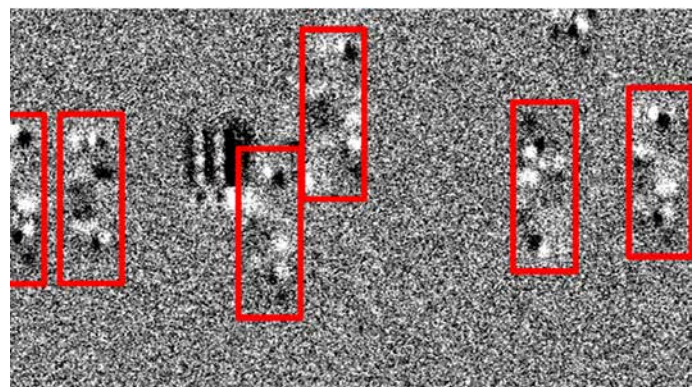
Safety compliance:
- Semi S2, S8

CAD:
- Avalon, NEXS

Electrical and thermal interface:
- 350 sq cm, two panels on the SEM door can be used as electrical and thermal feedthroughs

Phase map of flip flops at 5 nm technology node.

Learn more at **thermofisher.com/meridianex**